

Journal of Research of the

National Institute of Standards and Technology

he National Institute of Standards and Technology was established in 1988 by Congress to "assist industry in the development of technology . . . needed to improve product quality, to modernize manufacturing processes, to ensure product reliability . . . and to facilitate rapid commercialization . . . of products based on new scientific discoveries."

NIST, originally founded as the National Bureau of Standards in 1901, works to strengthen U.S. industry's competitiveness; advance science and engineering; and improve public health, safety, and the environment. One of the agency's basic functions is to develop, maintain, and retain custody of the national standards of measurement, and provide the means and methods for comparing standards used in science, engineering, manufacturing, commerce, industry, and education with the standards adopted or recognized by the Federal Government.

As an agency of the U.S. Commerce Department's Technology Administration, NIST conducts basic and applied research in the physical sciences and engineering, and develops measurement techniques, test methods, standards, and related services. The Institute does generic and precompetitive work on new and advanced technologies. NIST's research facilities are located at Gaithersburg, MD 20899, and at Boulder, CO 80303. Major technical operating units and their principal activities are listed below. For more information contact the Publications and Program Inquiries Desk, 301-975-3058.

Office of the Director

- National Quality Program
- International and Academic Affairs

Technology Services

- Standards Services
- Technology Partnerships
- Measurement Services
- Technology Innovation
- · Information Services

Advanced Technology Program

- Economic Assessment
- · Information Technology and Applications
- · Chemical and Biomedical Technology
- · Materials and Manufacturing Technology
- · Electronics and Photonics Technology

Manufacturing Extension Partnership Program

- Regional Programs
- National Programs
- Program Development

Electronics and Electrical Engineering Laboratory

- Microelectronics
- Law Enforcement Standards
- · Electricity
- Semiconductor Electronics
- Electromagnetic Fields¹
- Electromagnetic Technology¹
- Optoelectronics¹

Chemical Science and Technology Laboratory

- · Biotechnology
- Physical and Chemical Properties²
- Analytical Chemistry
- Process Measurements
- · Surface and Microanalysis Science

Physics Laboratory

- Electron and Optical Physics
- Atomic Physics
- Optical Technology
- Ionizing Radiation
- Time and Frequency¹
- Quantum Physics¹

Materials Science and Engineering Laboratory

- Intelligent Processing of Materials
- Ceramics
- Materials Reliability¹
- Polymers
- Metallurgy
- NIST Center for Neutron Research

Manufacturing Engineering Laboratory

- Precision Engineering
- · Automated Production Technology
- Intelligent Systems
- · Fabrication Technology
- Manufacturing Systems Integration

Building and Fire Research Laboratory

- Structures
- · Building Materials
- Building Environment
- · Fire Safety Engineering
- · Fire Science

Information Technology Laboratory

- Mathematical and Computational Sciences²
- Advanced Network Technologies
- · Computer Security
- Information Access and User Interfaces
- High Performance Systems and Services
- Distributed Computing and Information Services
- Software Diagnostics and Conformance Testing

¹At Boulder, CO 80303.

²Some elements at Boulder, CO.

Journal of Research of the National Institute of Standards and Technology

Volume 102 Number 3 May–June 1997

Board of Editors

Barry N. Taylor

Chief Editor

Nancy M. Trahey, Technology Services

Richard J. Van Brunt, Electronics and Electrical Engineering Laboratory

Theodore V. Vorburger, Manufacturing Engineering Laboratory

John R. Moody, Chemical Science and Technology Laboratory

Ronald Collé, Physics Laboratory

Cynthia Kreider Montgomery, Materials Science and Engineering Laboratory

Nicos S. Martys, Building and Fire Research Laboratory

Alan H. Goldfine, Information Technology Laboratory

Daniel W. Lozier, Information Technology Laboratory

Matt Young, Boulder Laboratories

Chris E. Kuyatt, Washington Editorial Review Board

Donald R. Harris

Managing Editor

Julian M. Ives

Technical Production Editor

Ilse E. Putman, Nancy L. Gogniat, Karen J. Wick

Electronic Composition



U.S. Department of Commerce—William M. Daley, Secretary
Technology Administration—Gary R. Bachula, Acting Under Secretary for Technology
National Institute of Standards and Technology—Robert E. Hebner, Acting Director

The Journal of Research of the National Institute of Standards and Technology features advances in measurement methodology and analyses consistent with the NIST responsibility as the nation's measurement science laboratory. It includes reports on instrumentation for making accurate and precise measurements in fields of physical science and engineering, as well as the mathematical models of phenomena which enable the predictive determination of information in regions where measurements may be absent. Papers on critical data, calibration techniques, quality assurance programs, and well-characterized reference materials reflect NIST programs in these areas. Special issues of the Journal are devoted to invited papers in a particular field of measurement science. Occasional survey articles and conference reports appear on topics related to the Institute's technical and scientific programs. ISSN 1044-677X Coden: JRITEF Library of Congress Catalog Card No.: 89-656121

Contents

Articles

The 1994 North American Interagency Intercomparison of Ultraviolet Monitoring Spectroradiometers	Ambler Thompson, Edward A. Early, John DeLuisi, Patrick Disterhoft, David Wardle, James Kerr, John Rives, Yongchen Sun, Timothy Lucas, Tanya Mestechkina, and Patrick Neale	279
Improved Photometric Standards and Calibration Procedures at NIST	Yoshihiro Ohno	323
Accurate Measurements of the Zero-Dispersion Wavelength in Optical Fibers	S. E. Mechels, J. B. Schlager, and D. L. Franzen	333
Creep and Creep Recovery Response of Load Cells Tested According to U.S. and International Evaluation Procedures	Thomas W. Bartel and Simone L. Yaniv	349
Computation of Fresnel Integrals	Klaus D. Mielenz	363
19th National Information Systems Security Conference First Annual Leveraging Cyberspace Conference	Ellen Flahavin Judi Moline	367 371
Conference Report 19th National Information Systems Security Conference	Ellen Flahavin	367
News Briefs		
GENERAL DEVELOPMENTS		375
Updated NVLAP Directory Now Available Workshop Proceedings Highlight Math Modeling New Monitoring Technique Gets Real World Test		
Reflectometer Enhancements Produce Record Sensitivity New Voltage Standard Performs Fast Switching Improved Magnetic Imaging Sample Coming		376
NIST Refines Probe Model, Improves Performance New Standard Makes Sense of Microcircuits FQA Implementation Now Set for May 1998		377
Reading Green Tea Leaves for Better Health Keeping Babies—and Their Parents—Breathing Easier New Method Combines Quick Imaging, Chemical Analysis Kid-Sized Data Goes Online		378

New Device Debuts for Measuring Thermal Conductivity EMMA and the RoboCrane Clean Up Together NIST and AIST/Japan Hold Information Exchange	379
Energy-Related Inventions Program Makes Recommendations NIST Helps Industry to Evaluate a Key Geometrical Parameter Describing Optical Fiber Connector Ends NIST Reference Sample Responds to Magnetic Recording Industry Needs to Compare Imaging Method Capabilities	380
Improvements Realized in the AWAMS Signal Processing Algorithms NIST Hosts Ion Implant Users Group Meeting Presenting Information on Alternative Sources, Thin-Film Metrology	381
Switzerland Joins Intelligent Manufacturing Systems; European Council Approves Membership Measuring Protein Electron Transfer Rates Using Electroreflectance Spectroscopy Electrical Optimization of Fluorinated Gas Plasmas	382
Aerosol Mineralization of Chlorofluorocarbons by Sodium Vapor Reduction Thermodynamics of Cyclodextrin Synthesis Biomimetic Surfaces Formed From Cell Membranes	383
Infrared Detector Arrays for Time-Resolved Spectroscopy New Half-life Value for the PET Radionuclide ⁶² Cu Determined Innovative Neutron Interferometer Design Achieves Record Performance	384
NIM/VME Instrument Standard Published Improvements to the Electrodeposition of Aluminum From Room Temperature Molten Salts	385
Improved Analysis of Heat Propagation in Stratified Media Nonlinear Ultrasonic Techniques for Microstructural Characterization Developed Patent Issued for Sensing Solidification of Casting X-Ray Diffraction	386
Nanocomposites: A New Flame Retardant Approach Experience Aboard the NASA DC-9 Reduced Gravity Aircraft NIST Fire Model Used in Design of Swiss Tunnels A Prototype Computer-Integrated Knowledge System for Predicting the Service Life of Reinforced Concrete Exposed to Chlorides NIST Develops Measurement Method for Lean Flammability Limits of Refrigerants	387
New Publication Describes Efficient New Search Engine Information Technology Report Ten Additional Federal Implementation Guidelines for Electronic Data Interchange Issued World's Timekeepers Not Second Guessing on June 30	388
New Additive Allows Hard Polymers Without Shrinking New Report Highlights Firefighter Safety Options International Meeting Focus: Enterprise Integration Study Cites Measurement Needs of Deregulated Industry	389
Revised DSS for Federal Agencies Under Consideration U.SGCC Standards in Trade Workshop Memorandum of Understanding Signed for Construction Materials	390

NIST Power Device Model Used to Develop Simulator Component Library for Interntional Rectifier IGBTs	
NIST Work Provides First Confirmation That High-Current QHE Dissipative States Are Quantized	
Interface Roughness Measurement Validated for Advanced Silicon MOSFETs Polycapillary Lens Shown to Increase Effective Detection Area by Factor of Over 100 for NIST Microcalorimeter X-Ray Spectrometers First Government/SRC Fellowship Established at Stanford	392
Quantum Enzymology Suggests Route to New Antibiotic Development New Methods for DNA Diagnostics Improved Procedures for Calibrating the Binding-Energy Scales of X-Ray Photoelectron Spectrometers	393
Mass Spectrometric Measurements Confirm PAHs Formed in a Diffusion Flame Novel Scanned Probe for Optical Characterization of Nanoscale Chemistry	394
Eley-Rideal Mechanism in the H Atom Abstraction of D from Si(100) Major Update of the NIST Chemistry WebBook New Thermodynamic Information for Silicon Nitride	395
Temperature Measurement for Rapid Thermal Processing NIST Radiochemistry Intercomparison Program (NRIP) Determining Reactor Pressure Vessel Neutron Fluence	396
Coherent Control of Wave Packet Dynamics New Grinding Fluid Chemistry Protects Diamond Tools Model Developed to Predict Alpha Case in Titanium Castings	397
NIST Patents New Method of Detecting Natural Gas Pipeline Flaws NIST Economist on U.S. Delegation to OECD Conference Librarians Burn Books in Large Fire Research Facility	398
NIST and Software Company Work Together to Apply MultiKron System New Release of NIST Form-Based Handprint Recognition System Published	399
STANDARD REFERENCE MATERIALS NIST Researchers Document SRM 1450c for Thermal Insulation Test Methods	399
STANDARD REFERENCE DATA Standards Reference Database on High-Temp Superconductors Upgraded	399
Calendar	401